

REMARKS

Applicants have amended claims 24 and 25, and have cancelled claims 11-23 without prejudice. Applicants also have added new claims 26-44.

Claims 24-44, of which claim 24 is independent in form, are presented for examination.

Election/Restrictions

Applicants affirm their election without traverse to prosecute the invention of Group II, claims 24 and 25. Applicants have cancelled non-elected claims 11-23.

Claim Rejections – 35 U.S.C. § 102

The Examiner has rejected claim 24 under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 5,316,877 ("Thackeray").

As amended, claim 24 recites a method of manufacturing an electrochemical cell, the method including providing a positive electrode including a lambda-manganese oxide, and after providing the positive electrode, forming a cell including the positive electrode and a lithium negative electrode.

But Thackeray does not anticipate claim 24. Thackeray discloses using LiMn_2O_4 as a cathode active material in a cell. (See Thackeray, col. 5, line 65 — col. 6, line 16.) Subsequently, the cell is charged to remove lithium from the LiMn_2O_4 , thereby forming $\lambda\text{-MnO}_2$. (See *id.*) Thackeray does not disclose providing a positive electrode including a lambda-manganese oxide, and after providing the positive electrode, forming a cell including the positive electrode. Rather, Thackeray discloses the formation of $\lambda\text{-MnO}_2$ in a cell that initially includes LiMn_2O_4 as its cathode active material. Accordingly, Applicants submit that Thackeray does not anticipate claim 24, and request that the rejection of claim 24 be withdrawn.

Claim Rejections – 35 U.S.C. § 102 or § 103

The Examiner has rejected claim 24 under 35 U.S.C. § 102(b) or § 103(a) as anticipated by or obvious over the abstract of JP 63-187569 (the “Furukawa Abstract”).¹

As amended, claim 24 recites a method of manufacturing an electrochemical cell, the method including providing a positive electrode including a lambda-manganese oxide, and after providing the positive electrode, forming a cell including the positive electrode and a lithium negative electrode, the cell having a closed circuit voltage of about 4V and a specific discharge capacity at a nominal discharge rate of 1 mA/cm² to a 3V cutoff of greater than 120 mAh/g. But Furukawa fails to disclose or suggest a cell having a closed circuit voltage of about 4V and a specific discharge capacity at a nominal discharge rate of 1 mA/cm² to a 3V cutoff of greater than 120 mAh/g.

Furukawa discloses a non-aqueous electrochemical cell having a negative electrode including lithium and a positive electrode including a manganese oxide represented by the chemical formula $\text{Li}_{1-x}\text{Mn}_2\text{O}_4$, in which $1 \geq X \geq 0$. (See, e.g., Furukawa, col. 2, lines 7-13.) Furukawa notes that when $X = 1$, “[t]he manganese oxide may comprise λ -manganese oxide”. (Id., col. 2, lines 20-22.) However, Furukawa does not explicitly disclose a cell having a closed circuit voltage of about 4V and a specific discharge capacity at a nominal discharge rate of 1 mA/cm² to a 3V cutoff of greater than 120 mAh/g, and thus does not explicitly disclose the method of claim 24.

The Examiner has asserted that Furukawa's battery would obviously have the claimed closed circuit voltage and discharge capacity (see December 6, 2004 Office Action, page 5), which Applicants understand to mean that Furukawa's battery would inherently have these features. But Furukawa fails to inherently disclose such a cell. As stated by the United States Court of Appeals for the Federal Circuit, one asserting that a reference inherently discloses certain subject matter must prove that the features are:

¹ Applicants refer herein to U.S. Patent No. 4,904,552, which claims priority to JP 63-187569, as “Furukawa”.

necessarily present [in the prior art reference] and that it would be so recognized by persons of ordinary skill. (Electro Sys. S.A. v. Cooper Life Sciences, 34 F.3d 1048, 1052 (Fed. Cir. 1994))

Here, the requisite standard has not been satisfied, at least because there is nothing in Furukawa that would indicate to a person of ordinary skill in the art that any of the cells disclosed therein have the closed circuit voltage and specific discharge capacity recited in claim 24. Rather, two batteries that both include lambda-manganese oxide can exhibit different electrochemical performance. As an example, in their specification, Applicants disclose that a lithium cell with a composite cathode containing $\lambda\text{-MnO}_2$ prepared from one spinel (spinel B) had a higher specific discharge capacity (135 mAh/g) than a lithium cell with a composite cathode containing $\lambda\text{-MnO}_2$ prepared from another spinel (spinel A), when discharged to a 3V cutoff at a nominal rate of about 1.0 mA/cm². (See Application, pages 13-14, including Table 2.) Thus, Furukawa's disclosure of a cell including $\lambda\text{-MnO}_2$ is not necessarily a disclosure of a cell having a closed circuit voltage of about 4V and a specific discharge capacity at a nominal discharge rate of 1 mA/cm² to a 3V cutoff of greater than 120 mAh/g. Accordingly, Furukawa fails to inherently disclose the method of claim 24.

Because Furukawa fails to disclose or suggest the method of claim 24, Applicants request withdrawal of the rejections of claim 24 under 35 U.S.C. § 102(b) and § 103(a).

Claim Rejections – 35 U.S.C. § 102 or § 103

The Examiner has rejected claim 25 under 35 U.S.C. § 103(a) as unpatentable over Thackeray or the Furukawa Abstract in view of U.S. Patent No. 4,246,253 ("Hunter").

As amended, claim 25 recites a method of manufacturing an electrochemical cell, the method including providing a positive electrode including a lambda-manganese oxide, and after providing the positive electrode, forming a cell including the positive electrode and a lithium negative electrode. Claim 25 further recites that providing the positive electrode includes preparing lambda-manganese dioxide by a method including contacting water with a compound of the formula $\text{Li}_{1+x}\text{Mn}_{2-x}\text{O}_4$, wherein x is from -0.02 to +0.02, adding an acid to the water and

compound until the water has a pH of 1 or less, separating a solid from the water and acid, and drying the solid at a temperature of 120°C or below to obtain the lambda-manganese dioxide.

The Examiner has asserted that it would have been obvious to use Hunter's method for preparing lambda-manganese dioxide in combination with Thackeray's or Furukawa's methods of preparing an electrochemical cell. (See December 6, 2004 Office Action, pages 5-6.)

But a person of ordinary skill in the art would not have been motivated to combine Hunter with Thackeray. As explained above, Thackeray discloses an electrochemical cell with a cathode that includes at least one electrochemically active compound having a spinel-type structure that can be represented by the formula $\text{Li}_{1+x}\text{Mn}_{2-x}\text{O}_{4+\delta}$ where $0 \leq x < 0.33$ and $0 \leq \delta < 0.5$. (See, e.g., Thackeray, col. 5, lines 28-33.) Thackeray touts the advantages of cells that include his compound and in doing so, also distinguishes his cells from cells that include lambda-manganese dioxide:

Although the theoretical capacities of the fully oxidized electrodes are less than that of $\lambda\text{-MnO}_2$, it is believed that this disadvantage is countered by the higher average oxidation state of the Mn cations in the starting electrodes as compared to LiMn_2O_4 and which suppresses the dissolution of Mn^{2+} cations when lithium is extracted from the electrode. Moreover, these electrodes offer greater stability on cycling compared to LiMn_2O_4 (Thackeray, col. 7, lines 38-50.)

Thackeray also notes that the "severity of . . . problems" associated with using a carbon (graphite) anode in a cell can be reduced by using his electrochemically active cathode compound. (See id., col. 4, lines 13-29.) A person of ordinary skill in the art, upon reading about the advantages of Thackeray's compound, would not have been motivated to use lambda-manganese dioxide instead of Thackeray's compound. Accordingly, Applicants request that the 35 U.S.C. § 103(a) rejection of claim 25 in view of Thackeray and Hunter be withdrawn.

A person of ordinary skill in the art also would not have been motivated to combine Hunter with Furukawa. The Examiner has asserted that,

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the method taught by Hunter to produce the lambda- MnO_2 [for Furukawa] because Hunter teaches that the product of an acid

treatment of LiMn_2O_4 is substantially pure MnO_2 ($\lambda\text{-MnO}_2$) whose x-ray pattern is nearly identical to that of the starting material LiMn_2O_4 . (December 6, 2004 Office Action, page 6.)

But Furukawa already addresses the problem on which the Examiner is relying as motivation to combine the references. Furukawa shows that λ -manganese oxide formed by his method, which includes immersing a spinel-type manganese oxide in acid, is pure, and that it has an X-ray diffraction pattern that is substantially similar to the X-ray diffraction pattern of LiMn_2O_4 :

It was confirmed through an atomic absorption analysis that the above acid treatment had completely removed the lithium content in the spinel type manganese oxide. . . . [Also, the] X-ray diffraction pattern of the [] λ -manganese oxide . . . is substantially the same as the diffraction pattern of the spinel type manganese oxide shown in FIG. 3 [i.e., LiMn_2O_4]. (*Id.*, col. 4, lines 20-27; see also col. 2, lines 31-32.)

Thus, a person of ordinary skill in the art, upon reading Furukawa, would not have been motivated to use Hunter's method of making λ -manganese dioxide, at least because Furukawa's method of making a λ -manganese oxide apparently already provides a pure λ -manganese oxide with an X-ray diffraction pattern that is substantially similar to the X-ray diffraction pattern of LiMn_2O_4 . Applicants request that the 35 U.S.C. § 103(a) rejection of claim 25 in view of Furukawa and Hunter be withdrawn.

New Claims

Applicants have added new claims 26-44, which all depend from claim 24 and are patentable at least for the reasons provided above.

Applicants believe that the claims are in condition for allowance, which action is requested.

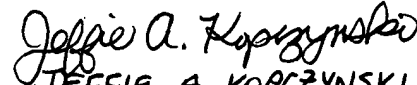
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Enclosed are a check for excess claim fees and a check for the Petition for Extension of Time fee. Please apply any other charges or credits to deposit account 06-1050.

Respectfully submitted,

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